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5 **ENERGY FACILITY SITE EVALUATION COUNCIL**
6 **STATE OF WASHINGTON**

7 IN THE MATTER OF APPLICATION
8 NO. 96-1

9 OLYMPIC PIPE LINE COMPANY

10 CROSS CASCADE PIPE LINE
11 PROJECT

APPLICATION NO. 96-1

PREFILED TESTIMONY OF JOHN
E. POWELL

EXHIBIT ____ (JEP-T)

ISSUE: GEOLOGY OF GINKGO
PETRIFIED FOREST STATE PARK
SPONSOR: WASHINGTON STATE
PARKS AND RECREATION
COMMISSION

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13 **Q. Please provide your name and business address to the Council.**

14 A. John Edwin Powell (known as Jack Powell)
15 Washington Department of Natural Resources
16 713 Bowers Road, Ellensburg Washington 98926

17 **Q. Please summarize your employment and educational background.**

18 A. I have worked for the Washington State Department of Natural Resources (DNR) since
19 1992. I have a B.S. degree in Geology from Central Washington University (1975) and a
20 M.S. degree in Geology from University of Idaho (1981). My master's thesis was a study
21 of the stratigraphy and structure of Columbia River Basalt. I participated in a CWU field
22 program doing geologic mapping in the Ginkgo Petrified Forest State Park area in 1971
23 and 1972. Dr. Robert Bentley, professor at CWU, and I studied the area as part of a
24 regional program for the Atomic Energy Commission in 1973. While doing graduate
25 studies, I worked summers for the following: U.S. Geologic Survey (USGS) in central
26 Colorado (1974); Union Carbide in Alaska (1975 and 1976); Cities Services Corporation,
mineral exploration in the Rocky Mountains (1977); and Timberline Mineral Company in

1 the Rocky Mountains (1979 and 1980). I was a college professor at CWU and Yakima
2 Valley College between 1981 and 1992. My teaching assignments included an
3 introductory geology class as well as classes in petrology, field methods, structure, and
4 mineral deposits. During these years I mapped large areas in south-central Washington
5 (including Ginkgo Petrified Forest State Park) for Shell Oil Company; Washington State
6 DNR; U.S. Department of Energy; and the USGS.

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8 While with the DNR (1992 to present), I have worked on surface mine reclamation and
9 watershed analysis as a slope stability (landslide) specialist. Presently, I am working in
10 the Forest Practices Division of the DNR mapping and evaluating landslides and
11 landslide-prone slopes across the State.

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13 **Q. Generally, what is the subject of your testimony?**

14 A. My testimony concerns the geologic history, stratigraphy, structure, and mapping of
15 Ginkgo Petrified Forest State Park, specifically where the fossil wood deposits are located
16 on the landscape, why these deposits are at these locations, and where the landslides are
17 within the park.

18
19 **Q. Are you familiar with the geology of the Ginkgo Petrified Forest State Park?**

20 A. I have traversed and mapped the geology of Ginkgo State Park as part of many projects
21 over the last 27 years. I compiled this work in 1984 for Dr. Bentley for a geologic map
22 produced for Shell Oil Company as part of a 500 square mile project region. The (1,000
23 feet to the inch) map shows the location of the fossil bearing unit and landslides across
24 the park. I have prepared a simplified version of this map, as it relates to Ginkgo
25 Petrified Forest State Park, and have attached it as Exhibit JEP-1 to my testimony. As
26 part of the evaluation of the Olympic Pipe Line proposed location, I have made the

original of this unpublished map available to the staff of the Washington State Parks and Recreation Commission and to Dr. Edward P. Klucking. I have roughly drawn the proposed pipeline route through Ginkgo with a dashed line.

Q. Please describe your findings as to the geology within the park.

A. The park is underlain by over a mile of Columbia River Basalt flows. These basalt flows erupted from fissures located generally where the states of Washington, Oregon, and Idaho meet. Most of the basalts erupted between 17 and 15.6 million years ago. Each flow would cover much of central Washington State, transforming it into a vast, flat, lava wasteland. By 15.6 million years ago, 97% of the total volume of the Columbia River Basalts had been erupted. The eruptions stopped for tens of thousands of years. The surface of the earth in central Washington sagged under the weight of these lava flows and a great lake (Lake Vantage) developed. A sand and clay layer known as the Vantage Member (or Vantage Interbed) was deposited in this vast fresh water lake. The Vantage Interbed is well exposed in a road cut in the park along Rocky Coulee (Sec 19, T17N, R23E).

An eruption of a Cascade volcano produced mud flows which deposited trees, probably as vast log jams transported in lahars (volcanic mud flow), into this lake (this lahar deposit is visible in the road cut mentioned above). Conceptually, these tree laden lahars were probably similar to those recently deposited in Spirit Lake by the Mt. St. Helen's eruption, only on a larger scale over greater periods of time. When basalt flows resumed erupting from the south-eastern corner of Washington State, the Ginkgo Basalt Flow entombed the logs floating in Lake Vantage. Logs were buried within the lower third of the flow and later underwent silicification, creating what is commonly referred to as petrified wood.

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2 The Ginkgo Flow is characterized by numerous, large (cm size) honey-colored crystals
3 present throughout the flow. The Ginkgo Flow poured into ancient Lake Vantage
4 resulting in rapid cooling in the lower portion of the flow (the fossil bearing portion of the
5 flow) chilling the basalt and forming rounded structures of volcanic glass known as
6 pillows. The distinct color and character of the pillow complexes makes the fossil beds
7 easy to locate. Today fossil logs are found in this complex of yellow, altered volcanic
8 glass and pillow lava. This relationship of logs to lava flow is visible on the
9 interpretative trails in the park and along I-90 (Sec 26, T17N, R22E). Between 15.6 and
10 14.5 million years ago, six more basalt flows covered the Ginkgo Flow, and about 10
11 million years ago, the area began folding into ridges and then eroded into canyons.

12
13 During the last Ice Age (15,500 to 13,500 years ago), sequences of glacial dams located in
14 northern Montana periodically impounded a lake as large as Lake Erie. When the ice
15 dam failed, it produced some of the greatest floods the world has ever known. Flood
16 waters 1,200 feet deep swept over portions of Ginkgo Petrified Forest State Park. Ice-
17 rafted boulders found throughout the park located this high water mark. The ice dam
18 rebuilt itself through glacial action, then failed many times, scouring the park and
19 depositing rock (contained in icebergs) from northern Idaho and Canada along strand
20 lines throughout central Washington. Within the park, these floods undercut slopes and
21 triggered landslides up to a square mile in size (e.g., the landslide in Sec 1, T16N, R22E).

22
23 **Q. Are you familiar with the proposal by the Applicant in this proceeding, Olympic**
24 **Pipeline Company, to construct a petroleum pipeline through the park?**

25 **A.** Yes. I have been discussing the project with State Parks personnel since the spring of
26 1998. I have reviewed Olympic Pipe Line Company's application to State Parks for an

1 easement, the Draft Environmental Impact Statement on the Cross Cascade Pipeline, the
2 associated maps showing Olympic's proposed route, and I have walked the proposed
3 route through Ginkgo Petrified Forest State Park with Olympic and Parks staff.
4

5 **Q. With reference to Exhibit JEP-1 to your testimony, how does the route proposed by**
6 **OPL compare to the fossil beds you have identified?**

7 A. The blue line in the map (Exhibit JEP-1) shows the location of the Vantage Interbed,
8 which is the sediment deposited in ancient Lake Vantage 15.6 million years ago. The
9 sediment was deposited as a horizontal layer and has since been folded and faulted into a
10 rolling surface. The area has been eroded into canyons which expose this rolling surface
11 along the canyon walls. Although the sediment is only exposed on the hillslopes, it
12 extends through the hill to adjacent canyons.
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14 The orange unit on the map indicates the location of the lava flow above the Vantage
15 Interbed. Known as the Ginkgo Flow, the lower 1/3 of this flow contains the "fossil bed."
16 In those areas where the pipeline excavation crosses the lower third of the Ginkgo Flow,
17 it is probable that petrified logs will be intersected. Additionally, where the Vantage
18 Interbed and Ginkgo Flow are exposed on slopes above the proposed pipeline (as along
19 the northeast slope of Ryegrass Mountain Sec. 25 T17N, R 22E), pipeline excavations in
20 this area will encounter fragments of fossilized wood in alluvial fan deposits (see Exhibit
21 JEP-1).
22

23 To illustrate the stratigraphy of the Ginkgo fossil bed, I have created a cross section
24 diagram which is attached to my testimony as Exhibit JEP-2. The colors on the diagram
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1 correlate to the colors used in the map (Exhibit JEP-1), with blue representing the
2 Vantage Interbed and orange representing the Ginkgo Flow.

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4 The geologic map in Exhibit JEP-1 also indicates the location of landslides within the
5 Park. Most of the landslides are ancient, and are probably related to undercutting and
6 saturation from the Spokane-Missoula Floods. Some of these landslides are large
7 (covering more than a square mile), and portions of these large slides have been
8 reactivated post-floods (possibly in the last few 100 years). Presently these slides appear
9 dormant. However, undercutting or disruption of drainage patterns could reactivate the
10 slide (especially at the toes of the slides).

11
12 **Q. Do you have any concerns regarding potential impacts of the pipeline construction**
13 **on these fossil beds?**

14 A. Construction across the fossil beds is likely to damage fossils. Additionally this area
15 contains fossilized material lying on the surface which is subject to removal by
16 construction crews. (I have known people working on the construction of Interstate 90
17 and was often shown petrified wood acquired along its right-of-way during construction.)
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19 **Q. Given your expertise in geology, do you have any other concerns about the**
20 **proposed pipeline route through the park?**

21 A. The landslide crossings are the major concern regarding the proposed pipeline route
22 through the park. A survey line indicating the location of the pipeline crosses along the
23 upper rim of an 80 acre landslide in Sec 26, T17N, R22E. Steep head wall scarps are
24 prone to rapid erosion and slumping. It would be prudent to move the pipe line 50 to 100
25 feet north of the rim of this landslide. Olympic Pipe Line representatives informally
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1 agreed to this during our walk of the site, and noted that the survey line was in error as
2 illustrated by the location map which shows the alignment 100 feet north of the landslide.

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4 The proposed pipeline will cross a series of large landslides in the southern portion of
5 Ginkgo Petrified Forest State Park. The most recently active of these landslides is located
6 on the pipe line route near the south 16th corner of Sec 6, T17N, R23E along the western
7 section line. Unlike most of the mile-wide landslide area, this landslide has been active
8 post-Missoula Floods (possibly within the last few 100 years). Presently it appears
9 dormant. However, the pipe line is projected to cut through the toe of this slide and toes
10 of dormant landslides can be reactivated if they are over-steepened or their drainage is
11 disrupted. The geologic hazard due to landsliding is moderate in this area. However, it
12 should be considered in the engineering of this project.

13 DATED this _____ day of February, 1999.

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15 _____
16 JACK POWELL
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